

**2000 CALFED Science Conference  
Session Notes**

**Species of Special Concern**

Session Chair: William Bennett

Session Notetaker: James Hobbs

*Determinants of riparian bird species abundance and diversity: comparison of riparian forest and restoration sites in the central valley and comparison among watersheds - Nadav Nur, Point Reyes Bird Observatory*

- The Point Reyes Bird Observatory (PRBO) study sites for this project were the, Sacramento River, Cosumnes Reserve, and the San Joaquin River. Sampling for this project took place from 1994-1999.
- The authors were primarily concerned with examining three important questions, with respect to bird interactions with the CALFED restoration program.
  - 1. Is riparian bird diversity increasing over time on restoration sites?
  - 2. Do birds respond to microhabitat features?
  - 3. How has restoration affected nesting success?
- 1. Is riparian bird diversity increasing over time on restoration sites?
  - Secondarily are there differences between reserve and reference forest sites?
    - They used a point count survey
    - They quantified vegetation sampling
    - The authors used the Shannon–Wiener index & linear regression analysis with age of restoration and diversity
  - The authors found a strong positive relationship between bird diversity and the age of restoration.
  - They also found that riparian habitat and forests habitat had no trend in diversity, just restoration sites exhibited increased diversity over time
- 2. Do birds respond to microhabitat features?
  - The authors ran correlation between 20-microhabitat variables measure in the field against Spotted Towhee abundance.
  - 14 of the 20 variables were sign correlated.
  - Looked at the variables across the 3 watersheds.
  - The authors found that tree height was the most important variable explaining Spotted Towhee abundance, thus habitat structural diversity increases bird diversity
  - The authors pointed out that Spotted Towhee is a resident, understory nester in all 3 watersheds, and that structural diversity is most likely that factor influencing the population abundance.
- 3. How has restoration affected nesting success?
  - The authors conducted nest monitoring three times a year along a transect.

- The examined three study species, with 10 Sacramento river plots
- They used the Mayfield method.
- Nesting success was moderate for Black-headed Grosbeak but poor for Lazuli Bunting and Spotted Towhee. Spotted Towhee is a self sustaining population
- They found that nest failure; predation and parasitism by the Brown-headed Cowbird are big problems for birds.
- Overall there was poor nest success for 2/3 of the species, but no difference between forest and restoration sites. This was due to reduced habitat diversity (tree height) and predation.

#### OVERALL SUMMARY

- Restoration is attracting native birds.
  - The progression of restoration sites improves bird species diversity
- Reproductive success remains low overall, especially for under story birds.

*The yellow-billed cuckoo: a riparian species of concern in California* - David Gilmer, USGS.

1. The authors presented, first the basic life-history characters of the Yellow-billed cuckoo
  - The Yellow-billed Cuckoo is a Neo-tropical migrant bird,
  - The New Mexico area is the most common area to find the bird.
  - It lives in exclusively in riparian habitat.
  - It nests in willow and cotton wood, always close to water
  - Core habitat in California is Sacramento River and Kern County and in Colorado.
  - It is a secretive bird
  - Its extremely sensitive to disturbance, don't know territoriality. Need 20 hectare per breeding pairs and a close proximity to water and oxbow lakes
  - The decline in abundance is due primarily to logging of riparian habitat
2. The authors presented the censusing research currently taking place.
  - The Fish and Wildlife Service is reviewing for listing as endangered species. It is suspected to be a subspecies of the western Yellow-billed Cuckoo.
  - The Statewide study relying on historical data and information from amateur birders.
  - They used a call playback survey methodology derived from the Arizona Fish and Game.
  - They played the call 5 times to count calls from paired, unpaired and single males
  - Historical habitat was from Colusa Co. to Southern California.

- Monitoring took place from the river via canoe by playing a recorder coo call and counting responses.
- Monitoring was conducted three times a year: May, June, and two weeks later in July during the peak of breeding.
- Estimated contact rate was 50 percent of birds.

#### Results

- Kern County had 8 pairs and 10 single birds
- Colorado River had 2 pairs and 1 single.
- Northern California had 3 paired and 8 single.
- Sac River had 28 pairs and 25 singles.
- So. Cal had 0 pairs and 1 single.
- Historically Southern California produced the most birds, but now in 2000 the Sacramento River population is increasing, 36-40 mated 38-40 unmated.
  - The authors suggests that the birds may be moving North

#### Important Recent Findings

- The authors noted that the bird is starting to nest in Tamrais, which is taking over for willows.
- Sutter National Wildlife Refuge recently producing cuckoos. Don't know if this is new or that nothing has been reported to date had 7-8 pairs.
- Maybe keystone species of riparian habitat, flooding could be important as well.

*Waterfowl ecology relative to recent habitat changes in the central valley of California - Joseph Fleskes, USGS.*

#### Background

- This study looked at waterfowl ecology throughout the CALFED project area including the Suisun Marsh and Central Valley from Tulare Basin to the Sacramento Valley.
- Over 90% of wetland habitat in the Central Valley has been lost since the 1800s
- Sacramento Valley wetlands were converted to rice fields whereas San Joaquin Valley wetlands were converted to agriculture of less value to waterfowl.
- About 20% of all North America waterfowl and half of all northern pintails (a species of special concern) winter in the Central Valley.
- The Central Valley Habitat Joint Venture (CVHJV) has worked since 1988 to improve habitats.
- CVHJV calculated waterfowl energy needs (and habitat goals) for each Central Valley basin assuming distribution of waterfowl like during 1970s and waterfowl population peaks in each basin in January.
- Wetlands increased 36% in Sacramento Valley and 9% in the San Joaquin Valley during 1985-95.
- Air quality concerns and reduced rice straw burning has led to increased flooding of rice fields in the Sacramento Valley as a way to decompose rice straw; 60,000 ha in the Sacramento Valley.

## Objectives

- To measure the response of wintering waterfowl to habitat changes and aid CVHJV planning.
- Assess any changes in wintering waterfowl distribution in the Central Valley
- Identify any changes in waterfowl movement patterns
- Measure relative importance of wetland and agricultural habitats
- Evaluate CVHJV habitat goals

## Methods

- Monthly aerial surveys of Central Valley, September to March, 1998-2000 & 1973-82
- Radio-tracking pintails, mallards, white-fronted geese and teal, 1998-2000 & 1987-94
- Compare with survey and tracking data from before recent habitat changes

## Results

- Waterfowl distribution and movements has changed during the last decade
- Lower % of Central Valley pintails and other dabbling ducks in Tulare Basin
- Lower % of Central Valley pintails and other dabbling ducks in Northern San Joaquin Valley during late winter
- Lower % of Greater White-fronted geese and pintails in the Delta.
- Greater % of waterfowl in East Sacramento Valley (Butte, Sutter and American Basin)
- Earlier exodus of San Joaquin Valley pintails to Sacramento Valley
- Fewer Suisun Marsh pintails visited the Delta or San Joaquin Valley
  - Waterfowl energetics have improved during the last decade
- Flight distance that pintails flew between roosting and feeding locations declined
- Flight distance declined more in Sacramento Valley (where habitat conditions have improved most) than in the San Joaquin Valley.
  - Habitat use varies among regions
- Seasonal wetlands in North San Joaquin Valley
- Flooded aglands early but wetlands late in Tulare Basin
- Rice fields provide most energy for most species in Sacramento Valley
- Corn and other aglands provide most energy in Delta
- Wetlands in Suisun Marsh
  - Availability of habitats varies by region and among species
- Hunting patterns vary among regions and impact habitat use
- Mobility of species vary and impacts habitat use
  - Use differs from what CVHJV habitat goals are based upon.
- All species except pintails and scaup near population goal
- Overall total Central Valley waterfowl use days similar to goal
- But use patterns (magnitude and timing) vary greatly among basins
  - MANAGEMENT IMPLICATIONS
  - CVHJV habitat goals need to be updated
  - Waterfowl distribution needs to be monitored with periodic surveys
  - Habitat changes impacts each waterfowl species differently

*Salt ponds and avian communities: will benefits of tidal wetland restoration exceed costs to waterbirds?* - John Y. Takekawa, USGS.

#### Objectives

What value are salt ponds to the abundance and diversity of species and communities in the estuary and how will CALFED restoration of salt ponds affect these assemblages.

- They examined historical surveys for waterbirds in the San Pablo Bay wetlands from 1982-1989 and compared values with 1999 surveys in salt ponds along the Napa River.
- Overall, they found a correlation between increasing salinity and decreasing taxa richness in invertebrates and fishes, but not waterbirds
- They found that there were slightly more waterbird species in baylands compared with salt ponds.
- They found that salt ponds exhibited much higher densities of waterbirds. Thus more baylands than salt ponds may be needed to support the same number of waterbirds.
- Waterbird diversity was similar in baylands and salt ponds.
- Examining foraging guilds, benthivores showed the biggest difference between salt ponds and baylands and were much more abundant in salt ponds.
- Dabblers increased and benthivores decreased in the North Bay ponds because of reduction in water depth. Canvasbacks seem to have declined drastically, from 8,000 to at most 2,000 in the ponds.

#### Conclusions

- Salt ponds are a little less diverse but have much higher densities for many waterbird species
- Diving ducks have decreased and dabblers increased after salt production ended in the North Bay.
- Restoration projects, and especially conversion from one type to another, must consider the negative effect that wetland conversion has on waterbirds
- Salt pond conversion to tidal marsh will likely reduce both shorebirds and waterfowl use.

*Monitoring white sturgeon year class strength in the Sacramento-San Joaquin estuary* - Raymond G. Schaffter, DF&G

#### Objective

To better index year-class strength and to predict recruitment to the sport fishery

## Methods

- Two sturgeon survey adult tagging (10) and Juvenile; this was too old so they need younger fish.
- Set line sampling 1800 feet long 20 hours overnight. 1ppt to San Pablo 25ppt.
- Target 50-70cm, monitor year-class strength

## Results

- 1991 was the upstart year, with no small fish 40-56mm
- In 1996-97 caught 1+ fish,
- 1982,83,84 were strong year-classes most likely due to high outflow.
- 1997 year-class exhibited very low distribution due to drought.
- 2000 had good data.
- 2000 age year class, '98-year classes good, '95 and '94 good, and '96 poor.
- The authors also found that they were undersampling fish less than 70 mm and larger than 100mm
- Trammel net catches from another survey were catching 102-180mm fish
- The Juvenile setline catches smaller fish 80-112.
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*Green sturgeon bioenergetics: temperature effects* - Ryan B. Mayfield, UC Davis.

## Goals of this study

Where to measure the effects of temperature on metabolism, food consumption, and efficiency and thermal preference, which was the behavioral component to the study.

## Background

Green sturgeon is a native chondrostean in the Sacramento system. From Alaska to Korea, believed to be in more marine areas. Why study sturgeon. Believed to be declining. CALFED species of concern. Also there is almost nothing in the literature. Temperature is important because it effects how a fish balances its energy, behavior and distribution. California has lots of temperature differences due to dams, thermal effluents etc. This makes it important to test how temp affects this species. Used bioenergetics to measure the effects of temperature, measure physiological response at the individual level. Presented a standard model of a bioenergetics. Used YOY to eliminate spawning energy.

## Expectations of the model

Expect metabolic rate to increase with temperature until a thermal maximum is met and then decline, we expect a similar response for food consumption and growth, thermal preference to increase with acclimation temperature.

## Methods

Fish were collected at the Klamath River and raised at the UCD facilities. Fish were acclimated to temperature for at least 7 days. Looking at the M component of the model. Feed similar foods as white sturgeon. Measured the energy allocation to maintenance by measuring the resting routine metabolic rate because these fish exhibit active movement in the tanks. Wound up measuring the routine metabolic rate and then accounted for movement using video imaging of tail beats, static respirometry to measure oxygen consumption that is indicative of metabolic rate. Static respirometry in a jar with oxygenated water added. This measures how much energy the fish is using.

## Results

We see a nice trend in temperature effect on metabolic rate at higher temps in 11-24 degree range we 2.5 fold increase in oxygen consumption, also looked at activity, temp increased activity as well.

So why look at metabolism?

Metabolism increases with temp, how much varies from species. Saw a high metabolic rate at increasing temperatures. Our data suggest a high metabolic sensitivity to temperatures.

Temperature and ration level affects the "I" component of model. Treatments were 11, 15 and 19. Half were feed to 100% and half 50% daily. Fish were weighed and measure every 10 days.

In short increased food consumption with increased temperatures.

Growth, with two rations, at 50% saw a nice trend with temperature but not at 100% so the full ration does not receive a benefit, probably due to the increase metabolic demands, thus decreasing the energy for growth, fish spends more energy running the body or increase in activity. No leveling off of growth for the 50% ration, so higher food conversion efficiency at higher temps for these fish. Significantly higher growth rates for the 50% ration group. Overall we see that growth rate increase with temperature, and ration level, however at the lower temperature we see no ration effect. Which may indicate a decrease in food conversion efficiency

Food conversion efficiency increases to some point of about 15 degrees and then levels off for both ration groups. Green sturgeon was more efficient at the 50% ration level rather than the 100% ration level for all temperatures.

Behavior, measure three temps 11, 19 and 24. Fish were placed into a thermal gradient tank. Gradient between 11 and 25. Fish were observed overhead with a video monitor. Fish seemed to prefer temperatures of about 15, which was where they were feeding and growing most efficiently.

## Conclusion

1. Metabolic rate and activity increases with temp
2. Food consumption, growth rate and conversion increased with temp
3. But found that conversion decreased with increasing ration levels'
4. Preferred temperature increases with increase acclimation temperature.

*Life history of the longfin smelt (Spirinchus thaleichthys) in the Sacramento-San Joaquin estuary, California* - Randall Baxter, CF&G.

## Objective

- This study was conducted using Fish and Game and the U.S. Fish & Wildlife Service monitoring data, to aid in the understanding of the life history and status of the longfin smelt. This information will greatly enhance the understanding of this species and its Potential response to CALFED restoration efforts.

## Life History

- In California, they range from coastal Northern California down to Monterrey but spawn only in the delta. Native to the San Francisco Estuary. Outside their range extends northward to Southeast Alaska.
- Historically one of most abundant fish in the estuary, number, # 3
- The abundance is strongly correlated with outflow even at lower Abundance.
- Life-cycle includes some time in the coastal ocean life, but to a smaller scale than salmon

## Results

- Life-cycle, Spawn in delta and lower rivers and move downstream; larvae are buoyant and transported downstream by surface currents. Juveniles use entire estuary at one point or another and to some extent in coastal ocean. Adults move into the marine waters at age two.
- Spawning areas are variable, based on outflow. Low flow years spawning occurs well above the confluence in the lower part of the rivers, but within the delta; in higher flow years spawning occurs just above the confluence downstream into Suisun Bay. At very high flows spawning occurs in the estuary formed by Coyote creek in lower South Bay.
- Life history strongly tied to flow. Larval abundance is well organized with peak in outflow in February. Because they spawn early! Larvae are surface oriented when the peak flows comes and are transported downstream by flow. When fish get bigger they begin to use the entire water column. (vertical migration)
- Where they wind up effects year class strength – Stronger year classes occur when larvae are transported to San Pablo Bay and weaker ones when most larvae remain in the lower river channels of the delta.
- In dry year recruitment is low and in wet years recruitment is high, and distribution is further downstream.
- In wet years individuals are bigger at age than during dry years.
- During wet year some one-year-olds could get big enough to reproduce, substantially effecting year-class strength and population dynamics.

## Conclusions



This information on the basic life history and status of the longfin smelt will greatly increase management's understanding of the recruitment dynamics, and its potential response to outflow and CALFED restoration programs. The longfin smelt is one species where winter outflow is the most important determinant of abundance. Outside activities leading to an estuary-wide increase in productivity, habitat restoration activities are unlikely to have detectable effect on longfin smelt abundance.

*Culture of delta smelt (Hypomesus transpacificus) in support of environmental and restoration studies* - Bradd Baskerville-Bridges, UC Davis.

#### Objective

- To produce the methodology for culturing and to supply larval delta smelt for research purposes

#### Findings

- Larval delta smelt hatch in about 10 days at 15 degrees centigrade and hatch out at about 5.5 mm
- Spawning lasts from February to July, but late season eggs are of poor quality.
- The fish have a low tolerance to stress.
- Larvae need turbidity to feed effectively
- Environmental conditions of the time of capture is important for transport survival
- Stressed fish often exhibit a saddlebacked appearance where the dorso-posterior of the fish turns white.
- Brood fish did not exhibit a two-year life cycle. Fish were kept beyond the first year and all gradually died.
- Fish spawn well in raw water from Clifton Court Forebay
- Rearing larvae or food for larvae is difficult with raw water
- 1999 implemented a water treatment plant. A recirculating filtration system and a flow through.
- Flow through had total mortality in 30 days, but if the water is filtered through the recirculating system we can grow larvae to 20mm and then move the fish to the flow through water system
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#### Special Study Projects

1. Video documentation of spawning behavior.
2. How current speed effect spawning behavior and substrate needs?
3. Feeding behavior of first feeding larvae, what are the required

conditions?

#### The Effect of Tank Size on Larval Survival

- In larger tanks we had better survival of larvae, maybe due to more efficient use of prey items.

#### The Effect of Temperature on Growth and Survival

- They are tolerant of wide temperature regimes
- Survival was poor for the high temperature treatment, but exhibited good growth

#### The Feeding of Larval Delta Smelt

- They conducted feeding experiments using three different types of materials to produce turbidity, Algae, Silt and Bentonite
- Feeding response increases with increased turbidity to about 25 NTUs.
  - ✓ Tested five levels 6.25, 12.5, 25, 50, 100, based on wild measurements
  - ✓ The silt treatment produced very poor feeding response in comparison to algae and Bentonite, only 50% of larvae eating at 50 NTU as compared to 80-90% in algae and Bentonite.
  - ✓ In clear water very few larvae were found to be eating.
- Light intensity
  - ✓ With increased light intensity feeding increases as long as there is turbidity
  - ✓ At low light levels larvae tend to stop feeding and move down in the tank.

#### Conclusion

- Culturing is now successful, and larval, juveniles and adults will be available for future research purposes.
- Larger tanks improve survival.
- Feeding requires turbid conditions.

*Spatial and temporal distribution of two copepods in relation to delta smelt* - Michael Dege, DF&G.

#### Objective

- The Department of Fish and Game's 20MM Survey was used to compare prey to predator springtime distribution from 1995 through 1999. Although, the primary objective of this survey was to monitor juvenile delta smelt, a secondary objective was to identify zooplankton associated with delta smelt. Zooplankton was sampled concurrently with the 20mm survey utilizing a Clark-Bumpus net attached to the trawl frame.

#### Results

- The native, *Eurytemora affinis* and introduced *Pseudodiaptomus forbesi* copepods have been identified as a major food component of delta smelt (*Hypomesus transpacificus*).
- Since its introduction, *P. forbesi* have displaced *E. affinis* both in the environment and diet of juvenile and adult delta smelt. Although, this

displacement is generally restricted to the warmer times of the year, *E. affinis* can still be prevalent in the winter and early spring months.

- A previous diet study indicated a delayed selectivity shift during the transition from one dominant copepod to the next.
- The habitat requirements of both prey and predator are similar and catch was assumed to be high in areas where preferred environmental conditions occurred.
- Inter/intra annual catch analysis indicated a partial overlap with a fragmented distribution over the delta and estuary. The degree to which overlap occurred could not be related directly to predator to prey interaction.
- While preferred environmental parameters could only account for some of the overlap. Copepod catch was generally higher in wet water years and smelt catch in average water years.
- Although, the distribution of *E. affinis* and delta smelt had a more landward shift during average flow conditions while *P. forbesi* did not. Such results suggest the distribution of juvenile delta smelt may be influenced by other factors besides prey distribution and density alone. Compounding these results are uncertainties of density dependence (both prey and predator) feeding behavior, and duration of overlap.

## Conclusions

- Although the diet of delta smelt has been identified as a possible factor for its decline, it's not known whether this transition from one species to another has any detrimental effects to the development of juvenile delta smelt. Aspects affecting the diet, including the distribution and density of preferred prey items could help answer recovery questions and in turn, improve management options.

*Density dependence, behavior, and environmental influences on delta smelt: implications for restoration* - William Bennett, UC Davis.

## Objective

- The objective of this research project was to provide testable questions on the population dynamics of delta smelt. This stock assessment relied on stock – recruitment modeling for delta smelt. Factors influencing the population dynamics were also analyzed with environmental and anthropogenic factors to explain residual values from stock-recruitment models. Life-History characteristics were also evaluated using hatch-date analysis from cultured and wild delta smelt, using otolith aging techniques

## Results

- Utilizing IEP databases, stock-recruitment relationships were modeled using density independent and density dependent fisheries models. The models were time lagged for interannual, intrannual and a 2-year time lag to examine different life-history scenarios.
- This exercise suggests density dependence occurs between the juvenile and adult stages, and that a 2-year time lagged model may provide the best explanation of the delta-smelt life history.
- This suggests that although delta smelt exhibit primarily an annual life-cycle, the few individuals that live a second year to spawn may contribute considerably more to recruitment than YOY individuals, Or that historically there were more individuals in the delta smelt population living to age 2.
- Also, the model suggests that density dependence within the delta smelt population might impede efforts of restoration, to increase population numbers.
- The residual values from the stock-recruitment model were correlated with a suite of environmental and anthropogenic factors hypothesized to influence population dynamics of delta smelt.
- The authors found significant correlation's of larval mortality with abundance of Inland silversides, suggest larval predation by silverside may adversely affect smelt abundance. Spring-Summer water exports were also significantly correlated with larval mortality.
- They also found that juvenile-adult mortality was significantly correlated with water exports during winter. This finding suggests that the take of pre-spawning adults significantly influence recruitment. In 1980-81 a significant proportion of adult delta smelt were salvaged during the winter at export facilities. This reduction in adults along with the loss of larvae during the 1982 extreme outflow event may have significantly contributed to the decline in the delta smelt population.
- Hatch-date frequency analysis of larvae hatched out in aquaculture facilities at Tracy and from back-calculation of hatch dates from otolith aging techniques suggests that delta smelt hatch out near or during neap tide cycles. In culture delta smelt eggs hatch in 9 days on average. This information taken with the hatch data analysis suggests that delta smelt spawn on spring tide-cycles, most likely at or near the mean-low water level on spring tides, to reduce the probability of egg stranding.

## Conclusions

- Excessive exports during the early 1980s and density dependence may have been important factors responsible for the decline and current regulation of delta smelt.
- Density dependence in the delta smelt population might impede CALFED restoration efforts.
- Delta smelt may have a spawning behavior that is influenced by the tide-cycle and this information may aid in the search for eggs and spawning delta smelt, as well as future modeling of the population.

*Review of the spring, real-time monitoring program in the Sacramento/San Joaquin Delta -*

Kevan Urquhart, DF&G.

Objective

The Real Time Monitoring Program was established in 1995 in accordance with the Bay-Delta Accord. This program was constructed for use as an adaptive management strategy and for early warning detection of important native fish species near the state and federal water diversions.

Background

- The IEP's spring, Real-time Monitoring (RTM) Program in the Delta is the collection and quick reporting of multi-species fisheries data, emphasizing three species (splittail, delta smelt and fall-run Chinook salmon smolts), from sites within the Delta, during April, May and June.
- RTM established sampling sites, which expanded on existing IEP, United States Fish and Wildlife Service (USFWS) and Department of Fish and Game (DFG) sampling programs. RTM collates fisheries data into a single database, and disseminates it within a 24 to 36 hour period.
- The data evaluation and dissemination process is hierarchical. First the CALFED/IEP's DAT reviews the results and prepares recommendations to minimize the impact of water operations via weekly or more frequent conference calls. Both RTM and the Water Operations Management Team (WOMT) forward recommendations to the CALFED Operation's Group, where decisions regarding operational flexibility are made.

Results/Conclusions

- The Real Time Monitoring Program has given managers an adaptive, flexible approach to the monitoring of important fish species in the Sacramento-San Joaquin Estuary.
- The predictive ability of the program to inform water export managers has been more difficult to produce than was expected, owing to the difficulty of understanding both how water flows through the delta and how fishes respond to such complex flows.

*Suisun bay area marsh conditions with numerous delta smelt postlarvae or adult splittail, CALFED target species - Christopher Kitting, CSU Hayward.*

Objective

- To evaluate the effects of marsh restoration habitats within the Suisun Bay area. In four marsh site, tidal action reinstated by dredging channels into

ponding areas in marsh sites. These sites were compared to reference sites within the region. Salinities in these marshes ranged from 8-15 ppt.

## Results

- After only one year restored tidal marshes exhibited high densities of adult splittail and other larval fishes, particularly larval herring, not delta smelt.
- Water conditions fluctuated with tide and daylight, due to the shallow marshes, similar in the upper and outer marsh, with neap tidal amplitudes ~3 ft (~1m), salinities 4~7 ppt (10~20% seawater, highest at low tide), temperatures of 12~17 degrees C (highest during daytime), and oxygen at 50~100% saturation (highest during afternoons).
- Our other sites had lower salinities and far fewer delta smelt. All sites had silt bottoms <1.5 m deep, marsh vegetation within meters, and 9~15-cm water clarity (low, as secchi depth).
- Splittail adult water conditions during daytime high tides were 1.6~4.9 ppt salinity, 14~16 degrees C, saturated O<sub>2</sub>, and 15~30 cm secchi depth.
- The most common fish captured was the yellowfin goby.
- The marshes were very productive for pacific herring larvae, with few delta smelt captured. Delta smelt were captured at 2 ppt. Along the Napa River.
- Highest densities of fishes were in channels where the marsh contained a pond, there were almost no fish caught when there was no ponding.

## Conclusions

- The restoration of marsh habitat within the Suisun Bay has proven to be very beneficial to important resident fishes of the estuary, including delta smelt, splittail, and Pacific herring.
- Fishes were found to be using newly restored habitats within only one year of restoration.
- Habitat conditions tended to be beneficial to native species, yet the exotic yellowfin goby was the most commonly found fish.

*Importance of Cosumnes River floodplain to chinook salmon and Sacramento splittail - Peter B. Moyle, UC Davis.*

## Objective

- The objective of this project is to assess the use of floodplain habitat by fishes.

## Results

- Splittail were the most common species found using the floodplain and the life history of the fish appears to be adapted to floodplain inundation. Splittail ascend the rivers to spawn, most likely spawning in floodplain habitat. Larvae

- stay on the highly productive floodplain to rear. Juveniles leave the floodplain and move out into the estuary to live one to two years.
- This study focuses on the Cosumnes River Preserve, which is owned by the Nature Conservancy
  - Flow patterns are very similar during the wet years. Flows peak in Jan-February.
  - This system is driven exclusively by rainfall, and without any impediment to flow, responds very quickly to rainfall.
  - Fishes were sampled using beach seining and boat electrofishing.
  - Chinook salmon and splittail the most common species. Chinook parr move onto the floodplain to rear in the high productive shallow warm waters of the flood plain. They move off the floodplain early, before the floodplain is cut off from the main channel of the river.
  - Splittail stay on the floodplain longer, after the barrier forms. Late spring rains appear to be very important to the splittail juveniles getting off of the floodplain.

## Conclusions

- Splittail were very abundant on the floodplain and appear to be very well adapted to temporary floodplain habitat.
- Floodplain inundation and spring time flows may be very important to splittail year class strength
- Juvenile Chinook salmon also utilizes the highly productive habitat of the floodplain.

*Fish assemblages and environmental gradients in the Cosumnes River basin* - Patrick Crain, UC Davis.

## Objective

This objective of this study was to monitor the fish communities throughout the Cosumnes River Watershed and to understand what biotic and abiotic factors are responsible for fish community structure

## Background

- The Cosumnes River is the largest stream in the Sierra Nevada's that has a natural flow regime and a functional floodplain.
- Summer flows are very low and the river is mainly tidally influenced in the lower reaches
- Fish were sampled throughout the basin to examine interactions between upper and lower watershed in an undammed stream.
- Canonical correspondence analysis was used to examine basin wide trends in fish assemblages.

## Results

- Elevation, stream gradient, water temperature, and turbidity were significant environmental descriptors related to different fish assemblages.
- Native fish dominated assemblages of the upper and upper middle portions of the basin. The lower middle reaches contained a mixture of alien and native fishes, while the lower portions were dominated by alien species.
- High elevation areas are dominated by, pikeminnow, roach, and trout
- Small mouth bass seemed to be the species most effecting the distribution of fishes in the middle to lower reaches of the river.
- In these reaches Bass appear to eliminate roach and suckers
- Trout dominate the high gradient areas
- Brook trout above and brown trout abundant below sly park
- Alien species are present throughout the basin, and dominate tidal reaches
- Smallmouth bass dominate foothill reaches.
- Some lamprey ammocetes found above the falls and Latrobe falls. Latrobe Falls are not a barrier to fish passage.
- The upper reaches are used very limitedly by anadromous fishes.

## Conclusions

- The results suggest that biotic and abiotic influences in the lower basin give alien species an advantage over native species and that the lower basin acts as a “sink” for juvenile native fish produced in the upper basin.